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Developing Children's Thinking Skills: Proposed TVOntario Initiatives

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DEVELOPING CHILDREN'S THINKING SKILLS:
PROPOSED TVONTARIO INITIATIVES

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EXECUTIVE SUMMARY

Although developing children's abilities to think, solve problems, and make decisions has always been an educational goal, emphasis on the development of these cognitive abilities is increasing. A growing number of school systems are introducing programs and strategies designed to enhance thinking skills. Ontario's Ministry of Education is no exception.

An examination of the spectrum of programs being developed to teach thinking skills suggests several ways that TVOntario can make a valuable contribution to these efforts. The major proposal in this report recommends production of television programs and support materials designed for both parents and teachers. As central role models in their children's lives, parents can use strategies for enhancing thinking skills to encourage their children's progress. The programs and materials will also be designed for teachers' use in professional development activities, either on their own at home or in an organized course.

The proposed television programs would begin with an overview of the various teaching strategies in use and go on to show the particular approach to teaching problem solving and related skills included in several Ontario Ministry of Education curriculum guidelines.

The learning resources designed to support the television programs would include videotapes which model in detail the particular techniques and behaviours that can be used by parents and by teachers at primary, junior, and intermediate/senior levels of the school system. Print materials would discuss the ideas and information covered in the television programs, but would focus primarily on the teaching strategies adults can use to assess children's thinking and support their progress to more complex levels. The value of personal contact with others interested in teaching thinking skills would be emphasized. School boards would be encouraged to offer workshops or courses and the support materials would include suggestions about working with others, such as guidelines for watching teachers or parents practice and providing feedback about their progress.

Early contact with directors of Ontario school boards is essential to the successful development of this project. Responses from the directors to an outline of the proposed resources will allow TVO producers to verify the desirability of this project, enhance the suitability of the resources, encourage on-the-job support for participating teachers, and estimate income from school board subsidies of participating teachers.

In Part B of this report, suggestions are made about promoting selected TVOntario television programs, utilization services, and possibly MOE software concerned with teaching thinking skills. Implications of the growing interest in thinking skills for future school television production and computer software development are discussed as well.

INTRODUCTION

> "To my mind the whole push and thrust and development of the world is towards the more complex, the flexible, the open-minded, the ability to entertain many ideas, sometimes contradictory ones, in one's mind at the same time." (Doris Lessing, 1986)

Particularly in the last 30 years, advances have been made in our understanding of how people store and organize information, how people become skilled in solving problems, and how the school environment can be structured to encourage learning. This wealth of knowledge and theory is now available as a basis for improving students' skills in thinking, learning, and problem solving.[1]

Parents and employers are asking schools to pay greater attention to developing these skills. Some of the more routine aspects of human labour are being performed or speeded up by electronic technology. As repetitive human labour is automated, a growing proportion of the remaining jobs require people who can assess new situations as they arise and make sound judgments. In this environment, employers are paying closer attention to their employees' abilities to reason, solve problems, and make decisions.

A new Ontario Ministry of Education (MOE) publication tells us that "over the next decade curricula will emphasize thinking and problem solving skills over the mastery of specific bodies of information. This new emphasis will represent a significant change for many teachers who have previously approached teaching from a subject-content perspective. These teachers will need to extend their own knowledge and understanding of thinking and problem solving processes, as well as to find ways to teach these skills to their students."[2] Curriculum changes are already evident in recent MOE guidelines. Interest in teaching thinking skills is also reflected in the growing number of programs being introduced in schools across Ontario (most often, ironically, in programs for gifted students).

With these curriculum changes and new programs comes a need to train teachers in new teaching strategies and to develop new instructional resources. The major portion of this report proposes that TVOntario produce a television series and support materials to show how both parents and teachers can assess children's problem solving skills and prompt further development of these abilities. This proposal is followed by a survey of TVOntario's inventory of classroom materials for teaching thinking skills--primarily television programs but also

computer software. Both promotion of current holdings and the production of additional programs and software are encouraged.

PART A

TEACHING THINKING SKILLS:
A PROPOSAL DESIGNED FOR PARENTS AND TEACHERS

CURRICULUM DEVELOPMENT: TEACHING THINKING SKILLS IN THE SCHOOLS

The rationale for this growing emphasis on teaching problem solving and decision making processes can be found, among other sources, in the research and development work carried out from the 1960s to the present by Floyd Robinson and John Ross of the Ontario Institute for Studies in Education, and by Len Popp, now at the Brock University Faculty of Education. Based on their work, MOE's 1985 policy support document titled "Shared Discovery: Teaching and Learning in the Primary Years" begins with the statement that "One of the main responsibilities of teachers is to help children to become effective problem solvers and sensitive decision makers." Several stages of skills involved in achieving these goals are set out in a sequence that moves from exploring to inquiring, predicting possibilities, planning and collecting, deciding, communicating, and evaluating.

MOE policy for the older grades was restated in a 1984 publication titled "Ontario Schools; Intermediate and Senior (OS;IS)." The Ministry's increasing concern with thinking skills is reflected in the first of 13 goals listed in the OS;IS policy: "Develop a responsiveness to the dynamic processes of learning which include observing, sensing, inquiring, creating, analyzing, synthesizing, evaluating, and communicating." As well, the newly released MOE publication, "Programming for the Gifted," and the draft curriculum guidelines being developed in History and Contemporary Studies, include detailed discussions of what thinking skills are and of the stages of development of problem solving and decision making skills.

In these documents, the MOE is striving to enhance the development of thinking skills by introducing new classroom teaching strategies in subject areas across the curriculum. The Ministry does not support programs that are designed to teach thinking skills such as reasoning, critical thinking, or problem solving as a distinct subject or skill in a separate course or program. While some schools are experimenting with programs like this (Part C of this report offers examples), the Ministry is uninterested in encouraging programs of this type.

Following the Ministry's lead, some teachers are developing classroom strategies to enhance the development of their students' thinking skills. Ministry staff estimate that about one-third of school boards around the province are now encouraging a thinking skills approach to

curriculum development and classroom teaching strategies. Marcia Turnbull and Lynne Hyne in TVOntario's School Utilization Services have designed a project with the Renfrew County Roman Catholic Separate School Board to develop teachers' television skills as part of a broader shift toward student-centred teaching strategies that reflect planning for individual students' cognitive growth. In some boards, more attention is being paid to creating an environment and using a range of teaching strategies that encourage students to play a more active role in managing their own learning. As a result, students become more conscious of their own thinking and learning.

In at least five other Canadian provinces, similar curriculum development activities and classroom programs are being introduced.[3] Chinese instructors are now studying Canadian education because "it teaches a student to be better at problem solving than Chinese methods do."[4] This widespread interest in teaching problem solving skills is producing a demand for both new instructional resources and teacher training materials. Judy Davies in TVOntario's Marketing department indicates a growing interest in instructional materials in this area. A research report recently released by the American Corporation for Public Broadcasting supports this conclusion. The second of nine "most promising subjects for new productions" is "basic skills and applications... which are expanding to include critical thinking, analytical skills, and problem solving."[5] In Toronto, a Canadian Conference on Thinking: Integrating Theory and Classroom Practice will be looking at a variety of approaches this November. The conference is being sponsored by the University of Toronto School of Continuing Studies and the Ontario Council for Leadership in Educational Administration whose American affiliate has been very active for several years in publishing reports on teaching thinking skills. The following proposal describes how TVOntario can help parents and teachers learn about new strategies for enhancing students' thinking skills.

EDUCATIONAL DESIGN

This section proposes production of a series of eight half-hour television programs supported by a set of learning materials. These educational resources will be designed to inform parents and teachers about the development of thinking skills and the strategies available for enhancing children's problem solving and decision making abilities.

This proposal is based on research and discussions with English-speaking teachers and educators. While we are confident that this proposal responds to current needs in English schools, we are aware that interest and training in teaching thinking skills is less widespread in Ontario's French schools at this time and that other

educational needs may be more pressing. However, recent research in French schools conducted by Stacy Churchill, Normand Frenette, and Saeed Quazi[6] documents the need for teacher training and updating classroom teaching strategies, a need that may be addressed in part by this proposal or by a variation of it. Additional consideration of the priorities in French schools is needed to determine whether parallel productions in French and English are desirable.

The television series will introduce the basic ideas and approach to a large audience of parents and teachers in all grade levels and subject areas. Through examples and demonstrations showing exchanges between adults and children, the common underlying sequences involved in developing thinking skills will be seen. The support materials will provide more detail on specific techniques for observing and developing children's skills in problem solving and decision making. Very specific information, examples, activities, and advice will be prepared for several groups: parents, primary teachers, junior level teachers, and intermediate/senior teachers. Interested teachers and parents will learn to identify children's present problem solving strategies and to guide students' progress to the next levels of skill.

Parents have a central impact on how children's cognitive skills develop. They show their children how to see, think about, and deal with the world around them. In responding to their children's thinking and behaviour, parents can provide encouragement for the growth of independent thinking skills.

The ideas and examples in the proposed programs and support materials would increase parents' awareness of how children's thinking skills develop. Parents will become more attuned to their children's thinking processes. They will learn ways to encourage their children's progress and help with any difficulties.

Two major questions underlie the design of this proposal: what is the most desirable approach to teaching thinking skills and how can this approach be introduced in schools?

How to Teach Thinking Skills

In preparing this proposal, extensive research was carried out concerning the various programs and approaches now being introduced in schools. The proposed television programs and materials would introduce a selection of these programs and strategies, including some that focus on teaching thinking skills as a separate area of study. Descriptions of several programs and a critical overview are included in Part C of this report.

The teaching strategy selected for suggested TVO programming focuses on integrating the growth of students' thinking and problem solving skills with their learning of subject matter in all areas of the curriculum. The particular model selected was developed by Floyd Robinson and Len Popp at OISE and tested in classrooms over several years. It encompasses the features of a variety of approaches and, as mentioned earlier, has been adopted in several MOE guidelines. Floyd Robinson, head of the OISE field centres in the Northeastern and Midnorthern regions, contributed generously to the development of this proposal.[7]

The basic problem solving model developed by Robinson and Popp identifies eight stages in the problem solving process:

- identifying a difficulty
- formulating a problem
- suggesting alternative solutions
- collecting information about each alternative
- synthesizing the data to select the best alternative
- assessing the success of the solution selected
- solving the problem, and
- evaluating the chosen solution.

This basic problem solving method can then be varied to describe a decision making process by starting with a decision statement. The model can also be specialized to apply more closely to the methods used in different subject areas.

Robinson takes this model further by adding a unique element not seen in several comparable models of problem solving. He specifies the sequence of steps by which students acquire or learn this type of strategy. It is this process that teachers can learn and adapt to all grade levels and subject areas. The beginning of this process can be seen when students are first asked to make a decision, such as where a shopping mall should be built in their neighbourhood. Students will usually offer a solution such as "Build the mall downtown," and a rationalization such as "It'll be near our school so I can go to McDonalds." At the next level, students can suggest several alternatives and give good reasons for each. The third level will specify both advantages and disadvantages of several alternatives. A more sophisticated approach would list explicit criteria for making a decision. In the shopping plaza example above, these criteria might include the cost of land, the capacity of the roads, and the availability of shoppers. Each alternative is then judged positively or negatively by each criterion. Further complexity can be introduced into the decision making process by rank ordering the alternatives on each criterion or weighting the criteria.

Awareness of these developmental steps as well as the decision making model itself gives the teacher an additional tool for identifying students' stage of development, and for teaching students about decision making. Learning about this process encourages students to think about their own thinking and helps teachers to monitor and guide each student's progress.

While this process is sometimes criticized for being too rigid, it is not intended to displace the intuitive and affective components in decision making. Rather, it offers a tool for discussing the logical considerations involved in decision making with greater insight and for introducing additional perspectives on thinking skills. The creative aspects of thinking can be emphasized in developing alternative solutions or hypotheses, and a critical perspective can be encouraged when assessing alternatives. This model was selected not only because of its unique contribution in highlighting the developmental steps involved in decision making or problem solving, but also because its broad scope and framework can encompass creative and critical aspects of thinking.

How Schools Change

The second question underlying this proposal concerns the process of introducing change in schools. In light of the many failures in introducing innovations such as open concept classrooms or team teaching during the 1960s and 1970s, skeptics would question the potential success of 1980s attempts at curriculum reform and large scale teacher training efforts. However, the experience of failure itself has offered considerable insight into the difficulties of changing educational practices. Educators such as Ken Leithwood and Michael Fullan at the Ontario Institute for Studies in Education have described in detail why efforts to introduce change in schools have yielded few long term benefits. In their view, change must be seen as a lengthy process that depends on the personal involvement of each participant.

Based on research examining educational change, a current model of teacher training, developed by B. Joyce and B. Showers[9] identifies several essential aspects of the process: theory, demonstration, practice, feedback, and follow-up. In some situations, coaching teams (teacher-teacher, consultant-teacher) are set up to enhance the understanding and use of new teaching strategies or curriculum innovations. This type of program provides opportunities for training sessions, trying new practices, peer observation, exchanging experiences, and exchanging feedback. Because personal interaction is crucial for helping parents and teachers to learn new behaviour,

arrangements that encourage contact with other learners and with school board consultants are described in the section on support materials.

Learning materials such as television programs and print can introduce key ideas, influence viewers' perspective, and demonstrate different types of child-adult communication. It is our expectation that these resources can decrease the amount of live expert instruction and demonstration necessary and support peers wanting to learn together, even when consultants or face-to-face models are not readily available. However, it is important to recognize that the successful use of the materials suggested in this proposal depends on support from all levels of the elementary and secondary school system. Efforts to promote the successful utilization of these materials should be undertaken alongside production activities. Before addressing the educational objectives and content of the program and materials, the following section considers the best way for TVOntario to connect with the educational system to ensure the materials will be useful and well used.

TEACHER TRAINING NEEDS

As school boards adopt new Ministry curriculum guidelines which incorporate decision making and problem solving strategies, they will need to train teachers in using this approach. The Ministry's framework for TVOntario program development and programming priorities (issued in April of this year) reflects the need for this type of teacher training. Most specifically, the Educational Technology area in the French programming section of this document lists production aimed at teachers and parents concerning the development of thinking skills in students at all grade levels. In other sections, programming suggestions for mathematics, family studies, and geography include a problems solving/decision making approach to instruction. The programming and materials proposed here are designed to prepare teachers to adopt this approach.

Although the need for training teachers in teaching thinking skills is growing, there is a lack of pertinent teacher training resources, especially in the smaller school boards. Thus the value of TVO programming to support these efforts would be widely recognized. There is reason to anticipate that school boards and regional offices would view a TVOntario produced teacher training opportunity as a cost effective means to help meet these needs, and would thus be interested in subsidizing teachers who enrolled in a TVO learning system designed for them.

It is recommended that the process used in developing the Computer Academy be repeated. All school board directors would be sent a proposal describing television programs and accompanying materials designed to help teachers develop students' problem solving skills. The proposal would be accompanied by a brief questionnaire about directors' response to the proposal, their willingness to subsidize teachers who participated in the TVO program, and about related activities now going on in the school board. Through this procedure, the degree of support for the project can be assessed, suggestions about the format and content of the series can be gathered, the possibility of providing local support can be suggested, and estimates of the number of teachers who would be subsidized can be made. This approach assisted the Office of Development Research in predicting the 10,000 registrants for the Computer Academy. We believe that increasing pressure on school boards from the Ministry to offer training in problem solving will generate considerable interest in the proposed TVO materials.

OBJECTIVES

The television programs and support materials will be designed with several objectives in mind. Participants who watch the television programs, use the support materials, and practice the techniques shown will be able to:

- explore current ideas about thinking skills and teaching thinking;
- see the diverse approaches now being introduced in classrooms to enhance different thinking skills;
- learn a general model of problem solving and decision making, and the variety of skills (such as comparing, correlating, hypothesizing) that can be taught within this model;
- understand the growth sequences and levels of performance involved in acquiring each of the skills needed in problem solving and decision making;
- acquire skill in identifying children's present levels of performance in the overall problem solving model and in particular steps;
- develop skill in planning activities and intervening in ways that will support children's progression to the next skill level;
- develop confidence in their ability to promote children's problem solving skills.

CONTENT OUTLINE

This outline describes the subject matter to be covered in the television series and support materials. A major portion of the television programs would be made up of documentary footage showing children talking with adults in school and at home and adults modelling the kind of behaviour that encourages children to think and express themselves. Some segments would be scripted but as much as possible should be improvised and natural. Animation and still graphics would be used to convey underlying concepts, illustrate models, or present information. Interviews with classroom teachers or with experts might be included as well. The overall format might be built around a small group of parents and teachers who raise questions, discuss issues and strategies, and lead into the documentary, narrative, animated, and graphic segments.

The content is presented here as a list of segments or topics organized in theme areas but not structured into program units. Again following the experience of the Computer Academy, the content areas outlined here, together with the research data gathered in preparing this report, would be used by the producers in designing the production of television programs and support materials. The first two areas consider the underlying ideas and perspectives. The remaining four focus more on techniques and demonstrations of adult intervention in the development of children's skills and on the process of integrating these strategies within the existing school culture.

Thinking About Thinking Skills

What do we mean by thinking skills? Several of the ideas in this area would lend themselves well to animation or graphic presentation. Interviews with experts would also be appropriate.

- Thinking skills form one area of human abilities that cuts across several areas of human intelligence as outlined in Howard Gardner's list of multiple intelligences (linguistic abilities, musical abilities, logical/mathematical, spatial, bodily/kinesthetic, and personal abilities);[10]

- Thinking encompasses a wide range of abilities and skills: show variety and range, list most common types, stress the importance of reflection, thinking for yourself, independent thinking;

- Thinking skills are important to human growth and development, to people's senses of moral judgement, personal responsibility, independence, self-worth;

- Most or all thinking skills are present and visible at a very early age and develop in complexity as age increases (this view differs from Piaget's approach which stresses the emergence of new abilities at different ages);

- Most of these abilities develop to some extent without special attention--maturation and experience contribute;

- In different times and cultures, parents and teachers encourage different thinking skills, e.g., children should be seen and not heard; survival skills;

- With easy access to vast amounts of information, society needs to be concerned with making information meaningful, society will expect workers to be able to analyze, synthesize, solve problems, make decisions, assess a situation independently, act as responsible citizens in society;

- Value of learning skills as well as thinking skills.

Nurturing the Development of Thinking Skills

While later themes look at more specific techniques, this section looks at general features of the environment that encourage the development of thinking. Many of these environmental features could best be shown in family and classroom settings.

- The importance of interaction with others, especially adults--parents, teachers;

- The importance of being asked to express thoughts (as opposed to repeat factual information);

- The importance of personal meaning, involvement in each learning situation;

- The importance of being recognized, listened to, understood, appreciated;

- The value of discussing a question with others--of exchanging ideas, seeing the value in other perspectives, feeling the value of one's own ideas;

- The impact of encouraging and discouraging things parents do, teachers do, examples of specific interpersonal techniques such as negotiating contracts that give children greater responsibility for their learning activities and accomplishments;

- The value of an atmosphere of openness, curiosity, spirit of inquiry.

Special Programs in Schools

This section describes programs introduced in a small but growing proportion of schools, usually beginning in gifted or enrichment programs. Some names of involved teachers are mentioned here as examples. (Others are available in the research files.) In the television and print materials, parents and teachers will:

- Visit a variety of special programs--deBono (several schools), Philosophy for Children (George Ghanotakis, Ottawa), Westview Centennial Secondary School in North York (John Cameron);

- Explore the differences and similarities among these programs--links will be emphasized to show how various programs address related aspects of thinking processes and use similar strategies, e.g., group interaction is an important component in many programs;

- Examine the fit (and misfit) of different programs with existing school culture;

- Consider the question of whether skills learned in a special program or "thinking class" situation, such as looking at a situation from another person's perspective, are transferred to other school or life situations and how such transfer can be encouraged;

- Examine the value and difficulties of these programs.

Teaching Problem Solving and Decision Making

This section outlines the approach presented in Ontario curriculum guidelines. This strategy provides specific techniques that can be adapted to suit any grade level and subject area or can be used ouside school situations.

- Present the models developed by Robinson, Popp, and Ross which go beyond listing stages in decision making to focus on the developmental steps at each level, in particular the progression from identifying one solution to a problem and a suitable rationale, to considering several possible solutions, to specifying the criteria for a solution, assessing the options

against each criteria, and eventually developing more complex processes for weighting criteria;

- Show characteristic problem solving behaviour at each age/grade level, including the preschool years, primary, junior, intermediate, and senior levels;

- Stress the importance of observing children's behaviour, what to watch for at each age level;

- Introduce intervention techniques appropriate for each age level and each stage of problem solving skill;

- Show how to assess individual differences, unique needs, developmental gaps.

Variations of Problem Solving Techniques

The model presented in the previous section can be adapted to suit different subject areas and to encompass related aspects of thinking skills.

- Show how to reframe the problem solving model to yield a decision making process (by starting with a decision question) and show how techniques for encouraging students' growth can use a decision making framework in such subjects as social sciences, family studies;

- Demonstrate another variation (starting with a causal question) which produces the scientific method for use in science classes, show the use of intervention techniques in science at different grade levels;

- Show the similarities among the approaches used in varying subject areas, show examples of how students' development can be encouraged at each level in each subject;

- Show how to relate teaching problem solving skills to general thinking skills, e.g., lateral or creative thinking techniques can be brought in at the generating solutions or choices stage of problem solving, or critical thinking can be discussed with evaluating or ranking options in decision making.

Implications of a Thinking Skills Emphasis for School Culture and Organization

- Show the impact of this approach on children's development and students' learning--concept of "self-directed problem solver" discussed in MOE guidelines;
- Consider the role and importance of school support, board support in changing teaching strategy;
- Show the features of teacher training necessary to change teaching strategy--show teachers working together--modelling, giving feedback, doing practice lessons;
- Consider the changes in the role and skills of teachers as they shift perspective--include teachers' testimony;
- Assess the implications for selecting appropriate curriculum resources;
- Consider the implications for testing and grading students;
- Consider the resistance that can be expected to greater student control that accompanies a thinking skills approach.

LEARNING SYSTEMS DESIGN

Television

The learning system will be built around a series of eight 30-minute television programs designed primarily for parents and teachers, but older children and adolescents will likely be drawn to the programs as well. On-location and scripted sequences, animation, and interviews can all be used effectively to convey the ideas, strategies, skills, and techniques listed in the content section above. Some of the underlying ideas about intelligence and thinking processes can be brought to life in animated sequences. Actual and dramatized situations will be shown to reveal children's thinking processes and the ways adults' intervention can encourage and direct thinking experiences effectively.

A variety of approaches to achieving this goal will be shown. For example, viewers might see small groups of children discussing such propositions as "every student should spend three months every year earning money" in a classroom using the CoRT program developed by Edward deBono. Or Matthew Lipman, developer of the Philosophy for Children program, might describe how talking about ideas can teach

children to become reflective, self-critical, skilled in moral reasoning, and less easily swayed in their thinking by emotion.

As described earlier, one particular strategy for promoting problem solving and inquiry skills referred to in MOE guidelines will be singled out for more detailed demonstration. In recent years, Floyd Robinson in North Bay, John Ross in Peterborough and Toronto, and Len Popp in St. Catherines have been teaching this strategy to teachers and refining it on the basis of classroom experience. Several of the teachers involved and their classrooms could be invited to appear in the television series to demonstrate how the teachers learned the skills and techniques they use and how the strategy operates in the classroom. Presenting teachers' stories about their experience as well as demonstrations of classroom activities and work with individual students could open viewers to their approach. Examples of parents using this strategy with their children would be modelled as well.

Support Materials

The support materials will be designed primarily for people wanting to learn the problem solving approach and intervention techniques introduced in the television programs. The support materials will be prepared primarily for individuals and small groups learning on their own, but will also be valuable in teacher training courses or workshops. Additional resources will be included for people wanting to know more about the nature and development of thinking skills.

Some of the support materials will be designed to relate closely to registrants' specific circumstances and help them link the ideas presented to their particular situation. While many of the resources will be prepared for all registrants, the videotapes and sections of the print materials will provide specialized information, examples, advice, and encouragement for the following groups:

- parents
- teachers of preschool and primary students
- teachers of junior students (grades 4, 5, and 6)
- teachers of intermediate and senior level students (grades 7 to 13).

Print Materials

Print materials will include:

- A summary of the television programs which will reinforce the essential ideas and information and fill in the gaps for those who miss particular programs;

- A description of the problem solving/decision making model, the stages involved in the process, and the steps children go through at different ages in acquiring each skill;

- Articles expanding on the specific intervention strategies appropriate for each age group, taking into consideration the most usual individual differences;

- A discussion of how other thinking skills are incorporated within this problem solving model, e.g., lateral thinking is useful at the stage of generating alternatives;

- Transcribed interviews with parents/teachers about the difficulties involved in learning to use these intervention strategies and the rewards of this approach. These interviews will relate personal stories and experiences which assist learners in making this approach personally meaningful. These personal reports can be especially useful in helping teachers or parents prepare for their first attempts to use the thinking skills strategy (possibly on audiocassette);

- Directions about using these materials, stressing the value of working with other individuals or a group/class when learning these techniques; ideas about learning activities to do with others (see personal contact section below).

Videotapes

Seeing the behaviour to be learned is an essential part of the process involved in developing new skills. Demonstrations that highlight key aspects of children's behaviour and provide models of appropriate intervention techniques can be presented effectively on videotape. While the television series will introduce the key ideas and show intervention strategies in family and classroom settings, lengthier videotape segments would focus more closely, in greater detail, on the individuals involved. Watching unedited sequences of interaction, possibly followed by some questioning of both the adult and the child about their expectations and feelings, will be of great value as a model for the parent or teacher interested in trying the strategies

themselves. These videotapes would provide material for group or class discussion as well as a 'how to' demonstration for individuals. In each set of support materials, three or four videotape segments, each approximately five to 10 minutes in length, will demonstrate various aspects of intervention strategies.

Personal Contact

In learning a new skill, personal contact is vital. Participants will be urged to learn with friends or colleagues in their community. To help people find other interested individuals, lists of participants in particular locations should be provided. The print materials would describe activities that pairs or small groups can do together and give instructions about watching others practice and offering constructive feedback. Every effort should be made to encourage school boards and regional offices of the MOE to provide meetings, workshops, and time with consultants to support teachers', and possibly parents', learning. Involving school boards and MOE regional staff in the design of the resources would be desirable in order to increase the likelihood of an easy fit with their plans and activities.

In situations where face to face contacts cannot be arranged, computer conferencing could allow people to communicate at a distance. Using the Guelph University-based CoSy conferencing system or a similar system, participants could exchange their classroom experiences in using these strategies and techniques, ask questions of others, and arrange related activities. Valuable research could be conducted to explore the benefits and difficulties of using this conferencing system to support teacher training activities.

CONCLUSION

As a coordinated learning system and as individual resources, there is every reason to believe that the materials described here will attract a large and appreciative audience. Several benefits to TVOntario could be expected as well:

- Programming and related learning materials pertinent to every parent and teacher in Ontario would be available for broadcast and VIPS distribution;
- Of considerable interest across Canada and beyond, this programming could be marketed widely;
- TVO would develop expertise in (a) using television to show model communication between teachers/professionals and students/clients

as a learning tool for those interested in extending their professional skills; and (b) encouraging and assisting professionals to use multimedia materials for learning in pairs or small groups. Production of training materials for other professional groups could benefit from this experience;

- TVO would develop expertise in producing television and related resources for teaching thinking skills which could then be applied to audiences outside the school system, e.g., postsecondary students, seniors.

Designing and producing the proposed television programs and learning resources will be very costly. To warrant large expenditures, contact with all school boards is an essential first step. Discussion with representatives from parents' and teachers' associations could be advantageous as well. Although the potential value of the project is enormous, expectations about utilization and cost recovery must be firmly grounded. Feedback from Directors of Education can verify the desirability of this project, enhance the suitability of the resources, encourage on-the-job support for participating teachers, and indicate the level of income that would be generated by school board subsidies of participating teachers. With this information and anticipated support in hand, a decision to proceed with production could be taken with well founded expectations of success.

PART B:

RESOURCES FOR USE IN THE CLASSROOM

This section begins by looking at TVOntario's current inventory of materials designed to teach problem solving or decision making skills to children. Based on the strengths of these materials, a pamphlet is proposed to encourage their use. At the same time, the flaws and limitations of current holdings are acknowledged. In light of the uneven quality of current programs and the growing demand for such materials, production of further series and possibly software is encouraged. Suggestions are made about the nature of these products and about implications of a thinking skills approach for school programming in general. An overview of computer software to teach thinking skills is presented and the extensive resources involved in this type of software production are discussed.

Among TVO's present inventory are several series appropriate to the kind of teaching of thinking skills discussed in Part A. Three of these series were produced by the Agency for Instructional Television (AIT), a North American consortium of over 50 state and provincial educational producers including TVOntario. Most notable among the series is ThinkAbout which includes 60 15-minute programs released in 1979. ThinkAbout focuses on the 'skills essential to learning' for fifth and sixth grade students. In its introduction, the teachers' guide states: "Independent learners have the confidence and ability to get along in a changing world. They can (1) effectively express themselves; (2) manage their own learning; (3) reason systematically; and (4) think flexibly. The goal of "ThinkAbout" is to encourage the development of and strengthen these qualities in young learners." (P5)

Trade-offs and Give and Take, also produced by AIT, adopt a thinking skills approach to teaching basic ideas in economics. Trade-offs uses 15 20-minute programs to look at the decision making process in the context of economics for students in grades 4 to 8. Also using a decision making model, 12 15-minute programs in the Give and Take series look at personal economics for students in grades 8, 9, and 10.

These series provide models of problem solving and decision making processes and encourage awareness of the steps involved. However, only a general approach is given. Stages or levels of performance for each step involved in the process are not described. The programs have also been criticized for being dated, uneven in production quality, difficult to relate to the Ontario curriculum, and American in style and appearance. Despite these limitations, skillful teachers are using these programs to good advantage. The teachers now using these series

are part of the small but growing minority of teachers in Ontario who are building classroom teaching around a thinking skills approach. The teacher training series proposed in the first part of this report would prepare teachers to use and build on the material presented in these series.

Two recent TVO series relate to skills development within a particular subject area. Geography Skills focuses mainly on the very specific skills of the geographer but the fnial program on problem solving takes a somewhat broader perspective. The series It's Your World takes a unique approach that combines "introductions to research skills with scenes of life in other countries or communities." The teachers' guide begins "It's Your World is a junior social and environmental studies series with a resource-based learning approach."

These five series are varied in their focus, but all support the growing emphasis on thinking skills. The shortage of instructional resources in this area and the growing demand suggest two courses of action for TVO. First, the materials now available could be promoted together in a pamphlet about teaching thinking skills, and second, additional programming should be produced and/or acquired.

PUBLICIZING TVONTARIO RESOURCES

First, a pamphlet is proposed to describe TVO programs, teachers' guides, computer software, and activities pertinent to teaching thinking and learning skills. This pamphlet would indicate TVOntario's involvement in this area, would inform teachers of TVO resources, and encourage their use. The pamphlet would identify the most appropriate grade levels and subject areas for each series or computer activity and would point out ways in which these TVO programs can be used in teaching specific units of the Ontario curriculum. Related resources and activities would be listed as well.

Such a publication would be aimed primarily at the school boards and teachers who are looking for materials with a thinking skills perspective. However, for those new to this perspective, some discussion of the basic models and features of skills-based teaching strategies could be presented. The teacher training programs and resources proposed could be promoted as well.

In addition to the five series listed above, this pamphlet could promote utilization of Program Two in the series Questions of Choice. This program draws attention to the growing emphasis on developing students' thinking skills rather than their mastery of particular information or subject matter. Questions of Choice was developed to encourage discussion among parents and educators about central issues

raised in the Ontario Schools; Intermediate and Senior (OS; IS) policy document. Program Two in this series offers adults a focus for discussing the value and place of teaching thinking skills.

Some of the computer software distributed by the OESS could also be described in the pamphlet. As the MOE's interest in teaching thinking skills has grown, it has funded the development of several computer software items which take this approach. For example, The Bartlett Family, a simulation of pioneer life, focuses on decision making and the consequences of decisions. Other software simulations and games such as Introduction to Grand Tour: Micromath Problem Solving, Izzit/Zoz,Zob,Zod, and Northwest Fur Trade could also be included. These software activities are used to draw attention to decision making and problem solving processes, and to other aspects of thinking skills such as memorizing or categorizing. Computer software designed to develop thinking skills is discussed at greater length later in this section.

Tthe pamphlet could indicate the availability of workshops developed in cooperation with School Utilization Services to demonstrate the thinking skills approach in the classroom and the use of relevant TVO materials. TVO School Utilization officers Lynne Hyne and Marcia Turnbull are very supportive of the five TV series described above. When possible in their current television workshops, they encourage teachers to adopt a skills teaching view of their students and of the learning materials they use. Hyne and Turnbull are familiar with the difficulties teachers have in adopting this perspective and the kinds of training that would be useful in encouraging a move away from content centred teaching. At present, they report, the teachers who view their students from a skill teaching point of view are the ones who use television especially well. In the Renfrew County RCSS Board, it was with the goal of enticing teachers toward this perspective that the Director of Education invited TVO to train model TV teachers.

As the emphasis on teaching thinking skills grows, so will the desirability of coordinating TVO products and services which adopt this perspective. Producing a pamphlet to promote TVO television programs, teacher training materials, OESS software, and School Utilization activities, will further enhance TVO's efforts and expertise in this area.

NEW SCHOOL PROGRAMMING

As well as the production and publication proposals outlined above, this investigation of teaching thinking skills offers brief comments and suggestions concerning the production of instructional resources for children--television and computer software--to support teaching thinking skills. The Children-At-School department's plan to produce

programs on problem solving are very timely. Compared particularly to the three AIT series, programs are needed that are more closely focused in terms of guiding the development of particular skills, are more clearly related to curriculum, more current, and more Canadian in style and appearance.

As mentioned earlier, practicing a skill is often not sufficient to improve performance over time. Rather, better results have been observed when rules for the skill are explained and made visible to the student, something that is rarely done. Programming that presents the steps involved in problem solving and decision making processes to junior level students would be especially useful.

At the secondary school level, programs that focus on teaching thinking and learning skills would need to address the needs of a particular subject area to attract teachers dealing with heavy curriculum demands. A document prepared for the Ministry in May 1985 by Floyd Robinson called The Case for Including an "Interdisciplinary Skills List" in the Ministry and Board Guidelines for Intermediate and Senior Divisions, charts the parallel skills outlined in intermediate level curriculum guidelines in English, History, Geography, and Science. In addition to attaching the programs to particular subject areas, the programs could draw attention to the similar skills found among several subjects and to the ways that common skills are used differently in different subjects.

As reflected in the MOE documents cited in the introduction, teaching thinking skills is becoming an underlying strategy in curriculum development. It can be expected that teachers will increasingly seek out materials that are consistent with this approach. Although the development of TVO school programs have generally attended to the views in the MOE guidelines, it appears that over the coming years programs developed to suit the thinking skills approach adopted in the guidelines will be used more widely. Developing and assessing proposals for school production from this point of view is recommended. Production of the television programs and materials recommended in Part A of this proposal would support this approach by preparing teachers to encourage thinking skills in regular curriculum teaching.

COMPUTER SOFTWARE

As mentioned earlier, the MOE is supporting some software designed to enhance students' thinking skills. So far, only a handful of educational software in this category (produced primarily by Sunburst and The Learning Company) is used widely and the number of appealing products has been increasing very slowly. For the most part, this software is being used in the classroom as a separate activity rather

than as part of a whole program. Under these conditions, its impact is especially hard to assess. So far little research on the value of this type of sofware is available.

Perhaps most widely used among resources concerned with enhancing thinking skills is the LOGO software developed by Seymour Papert and his colleagues over a 10 year period at the Massachusetts Institute for Technology. LOGO allows students to use the computer to draw with a few simple instructions, and to build routines out of these instructions. Students can develop several fundamental mathematical relationships and concepts inductively, based on their experience in programming the computer. This process, like the process involved in learning and using more difficult computer languages, is expected to develop students' thinking, planning and problem solving abilities. However, there are several substantial difficulties in assessing the value and impact of the LOGO experience on students' thinking.

While both encouraging and discouraging studies are reported in the journal LOGO in the Schools, the research summary offered by Douglas Clements, a respected educator from Kent State University, highlights the potential yet to be explored. He concludes that LOGO programming "appears to facilitate the development of specific problem solving behaviours...Even in the early years, children's problem solving processes in the Logo environment appear to be significant and powerful." William Higginson at Queens University, a colleague of Papert's, and Rina Cohen working at OISE and the North York Board of Education, are both conducting major studies of the use and impact of Logo. Efforts underway in classrooms and research programs are expected to indicate what benefits can result from children's work with Logo and how to structure or support the use of Logo to enhance students' thinking.

It is not unusual for manuals or promotional material accompanying computer software to make claims like this: 'The Factory teaches how to 'think ahead', break problems down into parts in order to solve them, pick the best problem-solving solutions.' However, the activities offered in this type of software are often hard to distinguish from the processes involved in playing a game or solving a puzzle, although some advantages of interaction and feedback are expected. Usually these software activities offer practice in particular thinking operations such as sorting, classifying, reasoning deductively or anticipating logical consequences, but with less attention to content than is found in many traditional paper and pencil activities. Several of the OESS software items fall in this category. Another Canadian software product called Mindpower, designed by Joe Koenig and distributed by SRA, can also be considered in this category.

Rarely does the computer software now available aim to enhance thinking by increasing students' active awareness of their thinking processes. Marlene Scardamalia and Carl Bereiter are now developing a computer system at OISE that aims to "upgrade the conceptual quality of what is learned and increase students' abilities to monitor, control, and improve their own learning." This project is now working with university students but the plan is to extend the model to younger students.

Were TVOntario to undertake a major computer software development project, this area would be worth considering. However, sizeable long term commitments of both time and money would be needed before worthwhile computer-based learning activities could be expected. On a smaller scale, development of a computer activity in accompaniment with production a television program and print materials could generate a set of closely related resources that would appeal to both teachers and students. The teaching strategies described in Part A could be used as the basis for developing integrated video, print, and computer-based materials for almost any area of the science or social studies curriculum. A topic such as "keeping the environment clean" or "exploring the sea" could be approached from a problem solving perspective using video, computer simulations and databases, and print materials to offer a set of learning activities for students. By beginning with close ties to the curriculum and developing sets of well-designed learning activities for students, the resulting resources will be very appealing to teachers and through them to students.

PART C:

BACKGROUND RESEARCH

In exploring the possible involvement of TVOntario in teaching thinking skills, research was conducted in several areas. Two major areas are reported here--the contribution of psychological theories to teaching thinking skills, and the variety of programs being introduced to teach thinking skills explicitly with little if any relationship to existing curricula or specific subject matter.

THEORETICAL BASES FOR TEACHING THINKING AND LEARNING SKILLS

Developmental Psychology

Based on the work of psychologist Jean Piaget, our understanding of the sequence of development of children's conceptual abilities has shaped much of our educational strategy. At the early elementary school level, there has been growing attention to enhancing students' cognitive development. During the first three grades, much of school activity is designed to provide experiences in matching, categorizing, patterning, and relating things, both as activities related to learning language and arithmetic, and as activities to promote cognitive development.

At about age 10 or 11 years, most students reach what Piaget called the "formative operations" stage. At this stage, students develop the ability to think about thoughts or theories rather than concrete realities. Children begin to think about what could be and about their own thinking experience. Once this stage is reached, the possibility of encouraging students' awareness and direction of their own thinking processes increases. Many of the suggested shifts in educational practice are related to this central idea. Some educators believe that instruction in thinking skills at this stage would be of particular advantage to students who seem to be heading toward basic and general rather than advanced level courses in secondary school.

Robbie Case at the Ontario Institute for Studies in Education has applied the notion of developmental sequence to the learning of particular problem solving tasks. Working primarily with students who have special needs, Case examines the variations in understanding of a particular concept among children of different ages and compares the performance of experts with the performance of novices. Through this process, a sequence of stages is outlined. This sequence is used to identify an individual student's level of performance of that task and specify the next step in that student's learning. Teachers can then

focus on finding an effective strategy for helping the student progress.

Educators since Piaget have questioned whether skills develop in a linear, age-related sequence or whether the skills are present in a simplified form at a very early age. In this view, rather than waiting for cognitive skills to develop spontaneously through maturation, early learning experiences can be designed to encourage and ensure the development of cognitive skills. For the significant minority of students where the transition to the "formative operations" stage fails to occur, a more active approach may encourage greater development.

The Information Processing Model of Learning

This model of learning is replacing the behaviourist model which focuses on the external behaviour of the learner. In the behaviourist approach, reward and punishment are used to shape habits and behaviour which in turn indicate that learning has taken place. In contrast, cognitive psychologists are concerned with the internal processes and structures that operate inside the learner's mind. Based on thousands of small but interrelated experiments in cognitive psychology and on artificial intelligence research, a model of these internal processes, called the information processing model, has been developed. This view of learning underlies virtually all of the programs described in this report.

The brief overview of the information processing model presented here introduces several of the model's basic features. The model begins by describing how various events and stimuli occurring in the environment activate our sensory receptors which relay this information to sensory registers located in the brain. Our sensory receptors and registers can hold only a limited amount of information for a very brief period varying from a fraction of a second to a few seconds, depending on which senses are involved. If information received in the sensory registers is to be retained, it must be transformed and stored temporarily in the short-term memory. The capacity of short-term memory is limited to approximately seven items (about the length of a telephone number), and after about 20 seconds the information decays. It disappears and is lost unless it is transferred to long-term memory.

From the huge array of activity in our environment, we choose those stimuli we want to pay attention to and possibly retain. Paying attention involves attending to the stimulus as it passes by the sensory register and then selecting certain aspects of the stimulus to store in short-term memory. Once information has entered short-term memory, it must then be rehearsed and coded so that it can be stored in long-term memory in a way that makes it retrievable. At this point the

information is related to earlier knowledge or experience and given personal meaning. The coding process involves hooking the new information to previously learned information and experience already stored in long-term memory. This search for personal meaning takes time and creates a problem because the short-term memory has a limited capacity. By means of rehearsal or repetition, the information can be maintained in short-term memory for longer periods to enable coding to occur.

Although individual learners have their own coding strategies, it is generally thought that people code information in sentences, images or episodes. As information is coded it is stored in long-term memory. Some authorities suggest that once information is coded and stored, it is never lost through time. What can occur is the problem of remembering or retrieval caused by the way in which the information was originally coded. In many cases, information cannot be recalled because the material is interfered with by previous or subsequent learning.

If the information can be retrieved successfully, we can verify that learning has occurred. Often what is retrieved is returned to the short-term memory and combined with other information to form new items. In other cases information is searched and retrieved directly without being brought to the short-term memory, as in recalling a familiar telephone number which is dialed immediately.

In addition to our ability to code and retrieve information, we have the ability to generalize learning to different situations. The recall of what has been learned and its application to new and different situations is called the transfer of learning. For example, if one has learned to add numbers of apples, this skill can then be transferred to adding cookies or dollars. The capacity to make this transfer is thought to involve additional rules which assist the learner in making the transfer and which can be taught. Learning for transfer means acquiring processes of retrieval that will apply in many kinds of practical situations.

This model describes how we receive stimuli, select stimuli for processing, store this informaton in short-term memory, and elaborate it so that it can be kept in long-term memory and retrieved when needed. Not surprisingly, many of the "discoveries" of this research confirm our intuitive and experienced-based understanding of these processes. However, there are new insights to be had as well. Efforts are now being made to use these ideas in designing more effective instruction, in developing better teaching strategies, and in producing better learning materials.

CLASSROOM PROGRAMS FOR TEACHING THINKING

As described throughout this paper, the Ontario Ministry and many school boards and teachers support a teaching strategy that guides and enhances the development of students' thinking skills within the study of particular subject areas across the curriculum. A minority of educators, on the other hand, encourage teaching thinking skills as a separate subject of study. Their concern with the general processes of reasoning, problem solving, or decision making leads them to emphasize these skills outside the teaching of particular subject matter. This section describes several programs that have been developed from this perspective.

From TVOntario's perspective, the approach adopted by the Ministry is of greater interest. Several factors support the Ministry's stance. The programs described in this section have not yielded consistent, demonstrable benefits for students. The uneven research findings arouse suspicions about the long term value of the programs developed to date. Most notably, it has been impossible to demonstrate that improving students' performance in the particular tasks provided in the programs has transferred to their performance when tasks or circumstances are altered. While these programs have undoubtedly offered benefits to some students in some situations, determining their value to a broad range of students in varying circumstances has been elusive. Nonetheless the rationales for these programs have considerable appeal and an awareness of these activities is valuable in understanding the growing attention to teaching thinking skills.

CoRT

The one program used more often than any other is Edward deBono's Cognitive Reasoning Trust or CoRT program, designed for both adults and children. The CoRT program is being used in schools in several countries, and in Venezuela has been incorporated as part of the school curriculum. The CoRT program was developed from deBono's knowledge and experiences as a biologist and psychologist rather than from any particular theoretical base.

DeBono stresses the importance of students' image of themselves as thinkers, as people with a skill that can be improved with practice. In his view, thinking is made up of perception and processing phases. The processing part is fairly routine compared to perception, the active system that allows information to organize itself as it is perceived. Many of deBono's lessons are designed to broaden people's perceptions, to encourage looking for different points of view, and to increase the ability to change perspective. To deBono, the fact that you are thinking doesn't mean that you are getting better at it, rather

that you are getting better at the particular strategies that you are using. Similarly, he sees critical thinking as limited in that it is only reactive, rather than creative or constructive. He thinks that simulations and games develop skill in the particular game but that there is no evidence that the skill learned transfers to different situations. Even the discussion method of teaching attends only to content and logic, with little or no concern for thinking processes and judgement.

The CoRT lessons in contrast are designed to create and teach thinking tools and to provide practice in their use. Each lesson involves a specific tool that is introduced and followed by group discussion exercises. Classes are divided into small groups of 5 or 6 to encourage more talking and to benefit from the dynamics of small groups. This situation differs from the usual class discussion in that teachers are not directing students' attention, but the students themselves apply the tool and direct their own thinking to the task at hand. DeBono sees these tools as being immediately useable in other situations because they are explicit and in the conscious awareness of the student. Ideally, a new tool or lesson is introduced each week and discussed twice during the week for fairly short periods when possible.

The tools themselves are largely attention directing devices that are applied and practiced in a wide variety of situations to become part of the students thinking strategies. Each tool is given a name--usually an acronym for the activity involved, e.g., PMI, the first tool, stands for Plus/Minus/Interesting. (This tool directs students to react to an idea from these three perspectives, not just from their initial impressions.) Each lesson includes a description of the tool, an example, topics for group practice, a discussion of the thinking process involved, and a statement of the principles or intent of the this tool. The topics for discussion are a mix of light fun topics, e.g., 'People should wear a badge showing whether they are in a good mood or bad mood that day,' and more serious topics, e.g., 'There should be a special TV channel for young people only.' While the ideas in each lesson are very straightforward, deBono stresses that the tools must be named and talked about as 'executive concepts' rather than presented as general ideas or suggestions.

Although the CoRT program can be used from grade 5 up, a scattering of schools in Ontario have introduced it typically in gifted programs at the intermediate level, grades 7 to 9. One of the important advantages of the system is that very little teacher training is required. However, difficulties are reported in fitting this program into an already crowded curriculum. At this time, controlled studies of the impact of the CoRT program are underway in Alberta and New Brunswick.

Instrumental Enrichment

Another program being assessed by several school boards in Alberta and British Columbia is the Instrumental Enrichment Program developed by Reuben Feuerstein in Israel. After World War II, Feuerstein began working with uneducated young concentration camp survivors. The program consisted of 13 different types of paper and pencil exercises which are repeated in cycles. The teacher plays an important role in directing students attention to the thinking processes involved in doing the exercises. Feuerstein found that this program could also be useful with other students as well. The need for extensive teacher training in the use of this method is a drawback.

Michael Luther, Chief Psychologist at the North York Board of Education, spent several months studying with Feuerstein in Israel, and then monitoring the use of the Instrumental Enrichment materials in North York schools. Although he has been unable to demonstrate any statistically significant improvement in student's performance, he has used the materials to develop a means of identifying cognitive strengths in low achieving students and using this information to enhance students' learning. The Instrumental Enrichment program itself has been criticized for focussing directly on the skills assessed in standard IQ tests, making it very difficult to evaluate its impact on actual ability rather than on IQ test performance.

Philosophy for Children

Philosophy for Children, developed by Matthew Lipman in the U.S. for students in grades 5 to 8, takes a very different approach. It consists of a series of texts in which fictional children in the course of the story think about thinking and about ways in which better thinking can be distinguished from poorer thinking. Through reading the texts and engaging in classroom discussions and exercises that follow the reading, students are expected to identify with the characters and learn to engage in the kinds of thinking depicted in the stories. Unlike the paper and pencil tasks used in the Instrumental Enrichment program, this approach assumes a grade appropriate reading level and a considerable knowledge base. Much of the material is integrated with the content in several subject areas. Also unlike the Instrumental Enrichment Program, it uses class discussion extensively and few written exercises.

This program is being introduced in a few Canadian schools in Ottawa, Montreal, and Winnipeg. Dr. George Ghanotakis at the University of Ottawa is providing training for interested Canadian teachers in using the Philosophy for Children approach.

The Westview Thinking Skills Project

The Westview Thinking Skills Project at Westview Secondary School in North York provides an example of how several programs and strategies can be combined or used together in one school. Developed largely by John Cameron, this project is designed to enhance Westview students' thinking skills and academic performance. While many programs are introduced first to gifted students, this program aims to increase the success of low achieving students.

One component of the program involves teaching the deBono CoRT lessons, levels 1 to 4, in all grade 9 and 10 English classes. The second component, called Project Advance, works with 75 students in grades 9 and 10 who have been identified as capable of working academically at a more advanced level. Because of the large number of recent immigrants and students from different cultural backgrounds at Westview, many of the texts typically used to assess Canadian students' academic level and needs are inappropriate. Based on the Instrumental Enrichment approach, a relatively culture-free test developed by Michael Luther, chief psychologist at the North York Board of Education, is used to identify students who are working below their capabilities and needs.

Project Advance is designed to upgrade these students in one year. A team of five teachers offers an integrated curriculum, using the Strategic Reasoning materials which present and provide exercises in six major thinking skills--identifying things, recognizing qualities, classification, structure analysis, sequencing, and syllogistic reasoning. Computer activities such as LOGO and word processing are used as well, and the cooperation among teachers provides opportunities for lessons and skills to be applied in different contexts.

The third component called "Learning About Learning" is a half-credit course given in grade 9 and 10, designed for the school's special education students. This course uses both deBono and Strategic Reasoning materials to provide students with strategies for taking in information and processing it, elaborating it, and expressing it. These strategies and skills are taught in relation to students' schoolwork in all of their subjects.

The programs described above indicate the most common approaches to explicit teaching of thinking skills now being explored in classrooms in Ontario and elsewhere. In addition to these structured programs, a growing minority of classroom teachers with an interest in this area are designing unique programs tailored to the subject matter and their particular students' needs. In Ontario, the efforts of such teachers are often based on skill development strategies outlined in the Ontario Ministry of Education's policy statements and curriculum guidelines, as well as the more established programs.

In support of teachers' involvement, the Ontario Secondary School Teachers' Federation has published an overview of several approaches, titled The Critical Concept: Strategies for Critical and Creative Thinking. A conference on this subject will be held in Toronto next November, organized by the University of Toronto Continuing Studies Department and the Ontario Council for Educational Leadership and Administration (whose American counterpart has published several widely cited articles in its periodical Educational Leadership).

NOTES

1. For an overview of these developments, see Howard Gardner's books, Frames of Mind: The Theory of Multiple Intelligences, New York: Basic Books, 1983, and The Mind's New Science: A History of the Cognitive Revolution, New York: Basic Books, 1985.

2. Tom Atkinson and Susan Sussman. Alternative Futures for Ontario Schools and Some Implications for Performance Appraisal System. Ontario Ministry of Education, 1986.

3. A summary of activities in British Columbia, Alberta, Saskatchewan, New Brunswick, and Newfoundland is available on request.

4. James Rusk, Globe and Mail, 6 January 1986, page A8.

5. Corporation for Public Broadcasting. Future School Market for Instructional Programming and Services Through 1990, Executive Summary. Washington, D.C., 1986, pp. 7, 36.

6. Stacy Churchill, Normand Frenette, and Saeed Quazi. Education et besoins des Franco-Ontariens: Le diagnostic d'un systeme d'education. Volume 1: Problemes de l'ensemble du systeme, L'elementaire et le secondaire. Toronto: 1986.

7. We are very appreciative of Dr. Robinson's contribution to this report. Although on study leave, Dr. Robinson gave freely of his time. When first approached, he convened a group of teachers who were known for their innovative skill practices and recorded their responses to our questions. Subsequently, he provided a detailed written response to further questions in a report entitled The Potential role of TVO in the Improvement of Intellectual Skills Performance in Ontario's Elementary and Secondary Schools. His cooperation was offered in the belief that OISE Field staff have an obligation to promote collaboration among those agencies involved in the improvement of public education.

8. John A. Ross and Florence J. Maynes. "Retention of Problem-Solving Performance in School Contexts," in Canadian Journal of Education, Fall 1985, pp. 383-401.

9. B. Joyce and B. Showers. "Improving Inservice Training: The Messages of Research." Educational Leadership, 1980, V37(5), pp. 379-385, and The Coaching of Teaching: Ensuring Transfer From Training. Palo Alto: Booksend Laboratories, 1981.

10. Howard Gardner. Frames of Mind: The Theory of Multiple Intelligences. New York: Basic Books, 1983.